

Effects on neuroprotein levels in cerebral cortex and hippocampus in mice after a single neonatal exposure to chlorpyrifos, endosulfan or carbaryl on postnatal day 10 (PND 10)

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A cocktail of various synthetic chemical compounds are diffused and ubiquitous in the air, soil and water as a result of medical, industrial and agriculture applications. Generally, all chemical compounds are toxic to all kinds of life if they exist in the components of environmental system at high concentrations. Toxicity of chemical compounds in mammals is mainly related to dose and time of exposure where they can adversely affect the brain development of a newborn and cause persist disturbances throughout the individual's life. Exposure to high doses of any chemical compounds will cause more adverse effects especially if the exposure occurs during early stages of life and in particular during a critical window of brain development which is called by brain growth spurt (BGS). The BGS is characterized by increase in brain weight and size as well as occurring crucial developmental processes. It occurs postnatally in mice and rats and continues up to three to four weeks after birth and peaks around postnatal day 10 (PND 10). In humans, the BGS is prenatal and it starts during the third trimester of pregnancy and spans up to two years of life. The vulnerability of mammalian brain to insults by toxic substances is relatively high during BGS compared to any other time of mammalian's life and adverse effects of neurotoxins might impact the developmental expression of biochemical molecules in the brain tissue. exposure to neurotoxins in this critical period may also lead to irreversible aberrations in cognitive functions, learning and memory at adult stage.

Pesticides are widely spread and used chemical compounds in industrial, agricultural and indoor purposes. Mammals are highly exposed to such compounds via ingestion, inhalation and dermal exposure throughout life stages. Newborns get exposed to pesticides via mother's milk and later via direct contact, inhalation the contaminated air and swallowing the indoor dust. A previous study has recently reported disturbances in normal behaviors of adult mice that have been neonatally treated with three different groups of pesticides (chlorpyrifos, endosulfan or carbaryl) on PND 10. Adult mice have showed a disturbed normal behavior after exposure to endosulfan and carbaryl. In this study, we analyzed the dissected brains of adult mice from the previous study and investigated the levels of the proteins GAP-43, CaMKII, GluR1, synaptophysin, PSD-95 and tau. These proteins are highly expressed during BGS and are essential for brain development and maturation. A decrease in levels of tau protein was observed after exposure to endosulfan or carbaryl while no effect was seen in tau levels after exposure to chlorpyrifos. Tau is essential protein in the outgrowth of neural processes, development of neuronal polarity and in maintenance of the normal morphology of neurons. Our results support the previous study showing that a single oral dose of endosulfan or carbaryl, on PND 10, can cause developmental neurotoxic effects in the adult animal.

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